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Comprehensive radiochemical analysis for nuclear decommissioning and waste management at DTU Nutech, Risø, Denmark

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Abstract

The Center for Nuclear Technologies, Technical University of Denmark (DTU Nutech) has long-term experience on characterization and radiochemical analyses of various waste materials and environmental samples from nuclear decommissioning activities. The radioanalytical laboratory at DTU Nutech is under accreditation standard DS/EN ISO/IEC 17025:2005, and capable of conducting all steps of sample processing, data analysis and customer support. Our state-of-the-art methods have been applied successfully for the determination of a wide range of difficult-to-measure radionuclides in various samples from decommissioning of nuclear facilities.

The laboratories include facilities suited for chemical and radiochemical analytical purposes. The radiochemical laboratory is well equipped for handling high radioactive samples (open sources) up to 10-100 GBq. The facilities include 32 low-level alpha spectrometers, 18 low-level gamma spectrometers, 35 low-level gas flow beta counters, two low-level liquid scintillation counters (TriCarb and Quantulus), one inductively coupled plasma optical emission spectrometry and two inductively coupled plasma mass spectrometry.

DTU Nutech has 15 years of experience in characterization and radiochemical analyses of materials from a number of nuclear decommissioning projects, as well as 60 years of experience in operating environmental monitoring programs. In this presentation, several examples will be given to discuss challenges and hands-on experiences in analysing hard-to-measure radionuclides from a broad range of decommissioning activities including: 1) nuclear research and power reactors (DR1, 2, 3 in Denmark, Barsebäck NPP in Sweden and Loviisa NPP in Finland) with particular emphasis on induced and surface contaminated radioactivity in different materials; 2) decommissioning of other nuclear facilities, e.g. hot cells in Risø, Denmark and Studsvik, Sweden with focus on surface contaminated radioactivity; 3) monitoring of the surrounding environment of nuclear decommissioning facilities and waste storage sites concerning radiation protection aspects.

Overview of hands-on experience in radiochemical analysis for nuclear decommissioning and waste management at DTU Nutech	
Radionuclides	^{3}H, ^{14}C, ^{36}Cl, ^{41}Ca, ^{55}Fe, ^{59}Ni, ^{63}Ni, ^{90}Sr, ^{93}Mo, ^{93}Zr, ^{94}Nb, ^{99}Tc, ^{129}I, ^{210}Po, ^{210}Pb, ^{226}Ra, ^{237}Np, ^{234}U, ^{235}U, ^{236}U, ^{238}U, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{241}Am and ^{244}Cm ^{60}Co, ^{94}Nb, ^{152}Eu, ^{154}Eu, ^{137}Cs, ^{134}Cs
Materials	metals, steel, graphite, concrete, plastic, soil, sediment, sludge water, ion-exchange resin, evaporated concentrate, sand, plaster, oil, cellulose/glass fibre filter, active carbon cartridge, heavy concrete (iron ball), PVC, PCB, swipe samples, paint, silica gel
References	Barsebäck NPP, Sweden Swedish Ågesta NPP, Sweden Studsvik Nuclear AB, Sweden Danish Research reactors (DR 1,2, 3), Denmark Danish hot cell, Denmark Loviisa NPP, Finland Ignalina NPP, Lithuania Australian Nuclear Science & Technology Organisation (ANSTO) Kvanefjeld mining site, Greenland